

WHAT IS CLAIMED IS:

- 1 1. A method for producing a fucosylated glycoprotein, the method
2 comprising:
3 contacting a recombinant fucosyltransferase protein with a mixture comprising
4 a donor substrate comprising a fucose residue, and an acceptor substrate on a glycoprotein,
5 under conditions where the fucosyltransferase catalyzes the transfer of the fucose residue
6 from a donor substrate to the acceptor substrate on the glycoprotein, thereby producing a
7 fucosylated glycoprotein,
8 wherein the recombinant fucosyltransferase protein comprises a polypeptide
9 having greater than 90% identity to an amino acid sequence selected from the group
10 consisting of SEQ ID NO:16 and 18.
- 1 2. The method of claim 1, wherein the polypeptide comprises an amino
2 acid sequence having greater than 95% identity to an amino acid sequence selected from the
3 group consisting of SEQ ID NO:16, 18, and 20.
- 1 3. The method of claim 1, wherein the polypeptide comprises an amino
2 acid sequence selected from the group consisting of SEQ ID NO:16, 18, and 20.
- 1 4. The method of claim 1, wherein the polypeptide further comprises an
2 amino acid tag.
- 1 5. The method of claim 1, wherein the method further comprises a step of
2 purifying the fucosylated glycoprotein.
- 1 6. The method of claim 1, wherein the acceptor substrate is selected from
2 a glucose residue and an N-acetylglucosamine residue.
- 1 7. The method of claim 1, wherein an acceptor substrate on the
2 glycoprotein comprises Gal β 1-OR, Gal β ,3/4GlcNAc-OR, NeuAc α 2,3Gal β 1,3/4GlcNAc-Or,
3 wherein R is an amino acid, a saccharide, an oligosaccharide, or an aglycon group having at
4 least one carbon atom.
- 1 8. An isolated polynucleotide comprising a nucleic acid sequence,
2 wherein the nucleic acid sequence has greater than 90% identity to a nucleotide sequence

3 selected from the group consisting of SEQ ID NO:15 and 17, wherein the nucleotide
4 sequence encodes a fucosyltransferase that catalyzes the transfer of a fucose residue from a
5 donor substrate to an acceptor substrate.

1 9. The polynucleotide of claim 8, wherein the nucleic acid sequence is
2 selected from the group consisting of SEQ ID NO:15 and 17.

1 10. The polynucleotide of claim 8, wherein the fucosyltransferase
2 catalyzes the transfer of fucose to an acceptor molecule selected from an N-
3 acetylglucosamine residue and a glucose residue.

1 11. An isolated polynucleotide comprising a nucleic acid sequence,
2 wherein the nucleic acid sequence encodes a fucosyltransferase that catalyzes the transfer of a
3 fucose residue from a donor substrate to an acceptor substrate, and wherein the
4 fucosyltransferase comprises an amino acid selected from the group consisting of SEQ ID
5 NO:16 and 18.

1 12. The polynucleotide of claim 11, wherein the fucosyltransferase
2 comprises an amino acid tag.

1 13. An expression vector comprising the isolated polynucleotide of claim 8
2 or claim 11.

1 14. A host cell comprising the expression vector of claim 13.

1 15. A method of producing a fucosyltransferase protein, the method
2 comprising the step of culturing the host cell of claim 14 under conditions suitable for
3 expression of the fucosyltransferase protein.

1 16. An isolated polynucleotide comprising a nucleic acid sequence,
2 wherein the nucleic acid sequence has greater than 90% identity to SEQ ID NO:19, wherein
3 the nucleotide sequence encodes a fucosyltransferase that catalyzes the transfer of a fucose
4 residue from a donor substrate to an acceptor substrate.

1 17. The polynucleotide of claim 16, wherein the nucleic acid sequence
2 consists of SEQ ID NO:19.

- 1 18. The polynucleotide of claim 16, wherein the fucosyltransferase
2 catalyzes the transfer of fucose to an acceptor molecule selected from an N-
3 acetylglucosamine residue and a glucose residue.
- 1 19. An isolated polynucleotide comprising a nucleic acid sequence,
2 wherein the nucleic acid sequence encodes a fucosyltransferase that catalyzes the transfer of a
3 fucose residue from a donor substrate to an acceptor substrate, and wherein the
4 fucosyltransferase has greater than 93% identity to SEQ ID NO:20.
- 1 20. The polynucleotide of claim 19, wherein the fucosyltransferase
2 consists of SEQ ID NO:20.
- 1 21. An expression vector comprising the isolated polynucleotide of claim
2 16 or claim 19.
- 1 22. A host cell comprising the expression vector of claim 21.
- 1 23. A method of producing a fucosyltransferase protein, the method
2 comprising the step of culturing the host cell of claim 22 under conditions suitable for
3 expression of the fucosyltransferase protein.
- 1 24. A recombinant fucosyltransferase protein comprising a polypeptide has
2 greater than 90% identity to an amino acid sequence selected from the group consisting of
3 SEQ ID NO:16 and 18, wherein the fucosyltransferase catalyzes the transfer of a fucose
4 residue from a donor substrate to an acceptor substrate.
- 1 25. The recombinant fucosyltransferase of claim 24, further comprising an
2 amino acid tag.
- 1 26. The recombinant fucosyltransferase of claim 24, wherein the
2 polypeptide is selected from the group consisting of SEQ ID NO:16 and 18.
- 1 27. The recombinant fucosyltransferase of claim 24, wherein the
2 fucosyltransferase catalyzes the transfer of fucose to an acceptor molecule selected from an
3 N-acetylglucosamine residue and a glucose residue.

1 28. A recombinant fucosyltransferase protein comprising a polypeptide
2 that has greater than 93% identity to SEQ ID NO:20, wherein the fucosyltransferase catalyzes
3 the transfer of a fucose residue from a donor substrate to an acceptor substrate.

1 29. The recombinant fucosyltransferase protein of claim 28, wherein the
2 polypeptide consists of SEQ ID NO:20.

1 30. The recombinant fucosyltransferase of claim 28, wherein the
2 fucosyltransferase catalyzes the transfer of fucose to an acceptor molecule selected from an
3 N-acetylglucosamine residue and a glucose residue.

1 31. A method of making a fucosylated oligosaccharide, the method
2 comprising:
3 contacting the recombinant fucosyltransferase of claim 24 with a mixture
4 comprising a donor substrate comprising a fucose residue, and an acceptor substrate
5 comprising a sugar or oligosaccharide, under conditions where the fusion protein catalyzes
6 the transfer of a fucose residue from the donor substrate to the acceptor substrate, thereby
7 producing a fucosylated oligosaccharide.

1 32. The method of claim 31, wherein the method further comprises a step
2 of purifying the fucosylated oligosaccharide.

1 33. The method of claim 31, wherein a donor substrate is GDP-fucose.

1 34. The method of claim 31, wherein the fucosyltransferase comprises an
2 amino acid tag.

1 35. The method of claim 31, wherein an acceptor substrate comprises a
2 member selected from N-acetylglucosamine and glucose.

1 36. The method of claim 31, wherein the acceptor substrate is Lacto-N-
2 neo-Tetraose (LNnT).

1 37. The method of claim 36, wherein the fucosylated oligosaccharide is
2 Lacto-N-Fucopentaose III (LNFP III).

- 1 38. The method of claim 31, wherein the mixture further comprises
2 lactose, a β -1,3-N-acetylglucosaminyltransferase, and a β -1,4-galactosyltransferase.
- 1 39. The method of claim 38, wherein the β -1,3-N-
2 acetylglucosaminyltransferase is a bacterial enzyme.
- 1 40. The method of claim 39, wherein the β -1,3-N-
2 acetylglucosaminyltransferase is from *Neisseria gonococcus*.
- 1 41. The method of claim 38, wherein the β -1,4-galactosyltransferase is a
2 bacterial enzyme.
- 1 42. The method of claim 41, wherein the β -1,4-galactosyltransferase is
2 from *Neisseria gonococcus*.
- 1 43. The method of claim 38, wherein the fucosylated oligosaccharide is
2 Lacto-N-Fucopentaose III (LNFP III).
- 1 44. A method for producing a fucosylated glycolipid, the method
2 comprising:

3 contacting the recombinant fucosyltransferase protein of claim 24 with a
4 mixture comprising a donor substrate comprising a fucose residue, and an acceptor substrate
5 on a glycolipid, under conditions where the fucosyltransferase catalyzes the transfer of the
6 fucose residue from a donor substrate to the acceptor substrate on the glycolipid, thereby
7 producing a fucosylated glycolipid.